

## Chapter 3. RUNWAY DESIGN

**300. INTRODUCTION.** This chapter presents standards for runways and runway associated elements such as shoulders, blast pads, runway safety areas, obstacle free zones (OFZ), object free areas (OFA), clearways, and stopways. Tables 3-1, 3-2, and 3-3 present the standard widths and lengths for runway and runway associated elements. Also included are design standards and recommendations for rescue and firefighting access roads. At new airports, the RSA and ROFA lengths and the RPZ location standards are tied to runway ends. At existing constrained airports, these criteria may, on a case-by-case basis, be applied with respect to declared distances ends. See appendix 14.

**301. RUNWAY LENGTH.** AC 150/5325-4 and airplane flight manuals provide guidance on runway lengths for airport design, including declared distance lengths. The computer program cited in appendix 11 may be used to determine the recommended runway length for airport design.

**302. RUNWAY WIDTH.** Tables 3-1, 3-2, and 3-3 present runway width standards which consider operations conducted during reduced visibility.

**303. RUNWAY SHOULDERS.** Runway shoulders provide resistance to blast erosion and accommodate the passage of maintenance and emergency equipment and the occasional passage of an airplane veering from the runway. Tables 3-1, 3-2, and 3-3 present runway shoulder width standards. A natural surface, e.g., turf, normally reduces the possibility of soil erosion and engine ingestion of foreign objects. Soil with turf not suitable for this purpose requires a stabilized or low cost paved surface. Refer to chapter 8 for further discussion. Figure 3-1 depicts runway shoulders.

**304. RUNWAY BLAST PAD.** Runway blast pads provide blast erosion protection beyond runway ends. Tables 3-1, 3-2, and 3-3 contain the standard length and width for blast pads for takeoff operations requiring blast erosion control. Refer to chapter 8 for further discussion. Figure 3-1 depicts runway blast pads.

**305. RUNWAY SAFETY AREA (RSA).** The runway safety area is centered on the runway centerline. Tables 3-1, 3-2, and 3-3 present runway safety area dimensional standards. Figure 3-1 depicts the runway safety area. Appendix 8 discusses the runway safety area's evolution.

a. Design Standards. The runway safety area shall be:

(1) cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;

(2) drained by grading or storm sewers to prevent water accumulation;

(3) capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and

(4) free of objects, except for objects that need to be located in the runway safety area because of their function. Objects higher than 3 inches (7.6 cm) above grade should be constructed on low impact resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches (7.6 cm) above grade. Other objects, such as manholes, should be constructed at grade. In no case should their height exceed 3 inches (7.6 cm) above grade.

b. Construction Standards. Compaction of runway safety areas shall be to FAA specification P-152 found in AC 150/5370-10.

**306. OBSTACLE FREE ZONE (OFZ).** The OFZ clearing standard precludes taxiing and parked airplanes and object penetrations, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function. The runway OFZ and, when applicable, the inner-approach OFZ, and the inner-transitional OFZ comprise the obstacle free zone (OFZ). Figures 3-2, 3-3, 3-4, and 3-5 show the OFZ.

a. Runway OFZ. The runway OFZ is a defined volume of airspace centered above the runway centerline. The runway OFZ is the airspace above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The runway OFZ extends 200 feet (60 m) beyond each end of the runway. Its width is as follows:

(1) For runways serving small airplanes exclusively:

(a) 300 feet (90 m) for runways with lower than 3/4-statute mile (1 200 m) approach visibility minimums.

(b) 250 feet (75 m) for other runways serving small airplanes with approach speeds of

50 knots or more.

(c) 120 feet (36 m) for other runways serving small airplanes with approach speeds of less than 50 knots.

(2) For runways serving large airplanes, 400 feet (120 m).

b. Inner-approach OFZ. The inner-approach OFZ is a defined volume of airspace centered on the approach area. It applies only to runways with an approach lighting system. The inner-approach OFZ begins 200 feet (60 m) from the runway threshold at the same elevation as the runway threshold and extends 200 feet (60 m) beyond the last light unit in the approach lighting system. Its width is the same as the runway OFZ and rises at a slope of 50 (horizontal) to 1 (vertical) from its beginning.

c. Inner-transitional OFZ. The inner-transitional OFZ is a defined volume of airspace along the sides of the runway OFZ and inner-approach OFZ. It applies only to runways with lower than 3/4-statute mile (1 200 m) approach visibility minimums.

(1) For runways serving small airplanes exclusively, the inner-transitional OFZ slopes 3 (horizontal) to 1 (vertical) out from the edges of the runway OFZ and inner-approach OFZ to a height of 150 feet (45 m) above the established airport elevation.

(2) For runways serving large airplanes, separate inner-transitional OFZ criteria apply for Category (CAT) I and CAT II/III runways.

(a) For CAT I runways, the inner-transitional OFZ begins at the edges of the runway OFZ and inner-approach OFZ, then rises vertically for a height "H", and then slopes 6 (horizontal) to 1 (vertical) out to a height of 150 feet (45 m) above the established airport elevation.

1) In U.S. customary units,  
 $H_{\text{feet}} = 61 - 0.094(S_{\text{feet}}) - 0.003(E_{\text{feet}}).$

2) In SI units,  
 $H_{\text{meters}} = 18.4 - 0.094(S_{\text{meters}}) - 0.003(E_{\text{meters}}).$

3) S is equal to the most demanding wingspan of the airplanes using the runway and E is equal to the runway threshold elevation above sea level.

(b) For CAT II/III runways, the inner-transitional OFZ begins at the edges of the runway OFZ and inner-approach OFZ, then rises vertically for a

height "H", then slopes 5 (horizontal) to 1 (vertical) out to a distance "Y" from runway centerline, and then slopes 6 (horizontal) to 1 (vertical) out to a height of 150 feet (45 m) above the established airport elevation.

1) In U.S. customary units,  
 $H_{\text{feet}} = 53 - 0.13(S_{\text{feet}}) - 0.0022(E_{\text{feet}})$  and distance  
 $Y_{\text{feet}} = 440 + 1.08(S_{\text{feet}}) - 0.024(E_{\text{feet}}).$

2) In SI units,  
 $H_{\text{meters}} = 16 - 0.13(S_{\text{meters}}) - 0.0022(E_{\text{meters}})$  and distance  
 $Y_{\text{meters}} = 132 + 1.08(S_{\text{meters}}) - 0.024(E_{\text{meters}}).$

3) S is equal to the most demanding wingspan of the airplanes using the runway and E is equal to the runway threshold elevation above sea level. Beyond the distance "Y" from runway centerline the inner-transitional CAT II/III OFZ surface is identical to that for the CAT I OFZ.

### 307. OBJECT FREE AREA.

The runway object free area (OFA) is centered on the runway centerline. The runway OFA clearing standard requires clearing the OFA of above ground objects protruding above the runway safety area edge elevation. Except where precluded by other clearing standards, it is acceptable to place objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes and to taxi and hold aircraft in the OFA. Objects non-essential for air navigation or aircraft ground maneuvering purposes are not to be placed in the OFA. This includes parked airplanes and agricultural operations. Tables 3-1, 3-2, and 3-3 specify the standard dimensions of the runway OFA. Extension of the OFA beyond the standard length to the maximum extent feasible is encouraged. See figure 2-3.

Precision Object Free Area (POFA). An object free area centered on the runway centerline extended, beginning at the Runway Threshold(RWT), 200 feet long and 800 feet wide. This area applies to all new authorized instrument approach procedures with less than 3/4 mile visibility as described in tables 16-1. See figure 3-6.

308. CLEARWAY STANDARDS. The clearway (See figure 3-7) is a clearly defined area connected to and extending beyond the runway end available for completion of the takeoff operation of turbine-powered airplanes. A clearway increases the allowable airplane operating takeoff weight without increasing runway length.

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a. Dimensions. The clearway must be at least 500 feet (150 m) wide centered on the runway centerline. The practical limit for clearway length is 1,000 feet (300 m).

b. Clearway Plane Slope. The clearway plane slopes upward with a slope not greater than 1.25 percent.

c. Clearing. Except for threshold lights no higher than 26 inches (66 cm) and located off the runway sides, no object or terrain may protrude through the clearway plane. The area over which the clearway lies need not be suitable for stopping aircraft in the event of an aborted takeoff.

d. Control. An airport owner interested in providing a clearway should be aware of the requirement that the clearway be under its control, although not necessarily by direct ownership. The purpose of such control is to ensure that no fixed or movable object penetrates the clearway plane during a takeoff operation.

e. Notification. When a clearway is provided, the clearway length and the declared distances, as specified in appendix 14, paragraph 7, shall be provided in the Airport/Facility Directory (and in the Aeronautical Information Publication (AIP), for international airports) for each operational direction.

**309. STOPWAY STANDARDS**. A stopway is an area beyond the takeoff runway, centered on the extended runway centerline, and designated by the airport owner for use in decelerating an airplane during an aborted takeoff. It must be at least as wide as the runway and able to support an airplane during an aborted takeoff without causing structural damage to the airplane. Their limited use and high construction cost, when compared to a full-strength runway that is usable in both directions, makes their construction less cost effective. See figure 3-8. When a stopway is provided, the stopway length and the declared distances, as specified in appendix 14, paragraph 7, shall be provided in the Airport/Facility Directory (and in the Aeronautical Information Publication (AIP), for international airports) for each operational direction.

**310. RESCUE AND FIREFIGHTING ACCESS**. Rescue and firefighting access roads are normally needed to provide unimpeded two-way access for rescue and firefighting equipment to potential accident areas. Connecting these access roads, to the extent practical, with the operational surfaces and other roads will facilitate aircraft rescue and firefighting operations.

a. Recommendation. It is recommended that

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the entire runway safety area (RSA) and runway protection zone (RPZ) be accessible to rescue and firefighting vehicles so that no part of the RSA or RPZ is more than 330 feet (100 m) from either an all weather road or a paved operational surface. Where an airport is adjacent to a body of water, it is recommended that boat launch ramps with appropriate access roads be provided.

b. All Weather Capability. Rescue and firefighting access roads are all weather roads designed to support rescue and firefighting equipment traveling at normal response speeds. Establish the widths of the access roads on a case-by-case basis considering the type(s) of rescue and firefighting equipment available and planned at the airport. The first 300 feet (90 m) adjacent to a paved operational surface should be paved. Where an access road crosses a safety area, the safety area standards for smoothness and grading control. For other design and construction features, use local highway specifications.

c. Road Usage. Rescue and firefighting access roads are special purpose roads which supplement but do not duplicate or replace sections of a multi-purpose road system. Restricting their use to rescue and firefighting access equipment precludes their being a hazard to air navigation.

**311. to 399. RESERVED**.

**Table 3-1. Runway design standards for aircraft approach category A & B visual runways and runways with not lower than 3/4-statute mile (1 200 m) approach visibility minimums  
(Refer also to Appendix 16 for the establishment of new approaches)**

ITEM	DIM <sup>1</sup>	AIRPLANE DESIGN GROUP				
		I <sup>2</sup>	I	II	III	IV
Runway Length	A	- Refer to paragraph 301 -				
Runway Width	B	60 ft 18 m	60 ft 18 m	75 ft 23 m	100 ft 30 m	150 ft 45 m
Runway Shoulder Width		10 ft 3 m	10 ft 3 m	10 ft 3 m	20 ft 6 m	25 ft 7.5 m
Runway Blast Pad Width		80 ft 24 m	80 ft 24 m	95 ft 29 m	140 ft 42 m	200 ft 60 m
Runway Blast Pad length		60 ft 18 m	100 ft 30 m	150 ft 45 m	200 ft 60 m	200 ft 60 m
Runway Safety Area Width	C	120 ft 36 m	120 ft 36 m	150 ft 45 m	300 ft 180 m	500 ft 150 m
Runway Safety Area Length Beyond RW End <sup>3</sup>	P	240 ft 72 m	240 ft 72 m	300 ft 90 m	600 ft 180 m	1,000 ft 300 m
Obstacle Free Zone Width and length		- Refer to paragraph 306 -				
Runway Object Free Area Width	Q	250 ft 75 m	400 ft 120 m	500 ft 150 m	800 ft 240 m	800 ft 240
Runway Object Free Area Length Beyond RW End <sup>3</sup>	R	240 ft 72 m	240 ft 72 m	300 ft 90 m	600 ft 180 m	1,000 ft 300 m

1/ Letters correspond to the dimensions on figures 2-1 and 2-3.

2/ These dimensional standards pertain to facilities for small airplanes exclusively.

3/ The runway safety area and runway object free area lengths begin at each runway end when stopway is not provided. When stopway is provided, these lengths begin at the stopway end.

**Table 3-2. Runway design standards for aircraft approach categories A & B runways with lower than 3/4-statute mile (1 200 m) approach visibility minimums**  
(Refer also to Appendix 16 for the establishment of new approaches)

ITEM	DIM <sup>1</sup>	AIRPLANE DESIGN GROUP				
		I <sup>2</sup>	I	II	III	IV
Runway Length	A	- Refer to paragraph 301 -				
Runway Width	B	75 ft 23 m	100 ft 30 m	100 ft 30 m	100 ft 30 m	150 ft 45 m
Runway Shoulder Width		10 ft 3 m	10 ft 3 m	10 ft 3 m	20 ft 6 m	25 ft 7.5 m
Runway Blast Pad Width		95 ft 29 m	120 ft 36 m	120 ft 36 m	140 ft 42 m	200 ft 60 m
Runway Blast Pad length		60 ft 18 m	100 ft 30 m	150 ft 45 m	200 ft 60 m	200 ft 60 m
Runway Safety Area Width	C	300 ft 90 m	300 ft 90 m	300 ft 90 m	400 ft 120 m	500 ft 150 m
Runway Safety Area Length Beyond RW End <sup>3</sup>	P	600 ft 180 m	600 ft 180 m	600 ft 180 m	800 ft 240 m	1,000 ft 300 m
Obstacle Free Zone Width and length		- Refer to paragraph 306 -				
Runway Object Free Area Width	Q	800 ft 240 m	800 ft 240 m	800 ft 240 m	800 ft 240 m	800 ft 240
Runway Object Free Area Length Beyond RW End <sup>3</sup>	R	600 ft 180 m	600 ft 180 m	600 ft 180 m	800 ft 240 m	1,000 ft 300 m

1/ Letters correspond to the dimensions on figures 2-1 and 2-3.

2/ These dimensional standards pertain to facilities for small airplanes exclusively.

3/ The runway safety area and runway object free area lengths begin at each runway end when stopway is not provided. When stopway is provided, these lengths begin at the stopway end.

**Table 3-3. Runway design standards for aircraft approach categories C & D**  
**(Refer also to Appendix 16 for the establishment of new approaches)**

ITEM	DIM <sup>1</sup>	AIRPLANE DESIGN GROUP					
		I	II	III	IV	V	VI
Runway Length	A	- Refer to paragraph 301 -					
Runway Width	B	100 ft 30 m	100 ft 30 m	100 ft <sup>2</sup> 30 m <sup>2</sup>	150 ft 45 m	150 ft 45 m	200 ft 60 m
Runway Shoulder Width <sup>3</sup>		10 ft 3 m	10 ft 3 m	20 ft <sup>2</sup> 6 m <sup>2</sup>	25 ft 7.5 m	35 ft 10.5 m	40 FT 12 M
Runway Blast Pad Width		120 ft 36 m	120 ft 36 m	140 ft <sup>2</sup> 42 m <sup>2</sup>	200 ft 60 m	220 ft 66 m	280 ft 84 m
Runway Blast Pad length		100 ft 30 m	150 ft 45 m	200 ft 60 m	200 ft 60 m	400 ft 120 m	400 ft 120 m
Runway Safety Area Width <sup>4</sup>	C	500 ft 150 m	500 ft 150 m	500 ft 150 m	500 ft 150 m	500 ft 150 m	500 ft 150 m
Runway Safety Area Length Beyond RW End <sup>5</sup>	P	1,000 ft 300 m	1,000 ft 300 m	1,000 ft 300 m	1,000 ft 300 m	1,000 ft 300 m	1,000 ft 300 m
Obstacle Free Zone Width and length		- Refer to paragraph 306 -					
Runway Object Free Area Width	Q	800 ft 240 m	800 ft 240 m	800 ft 240 m	800 ft 240 m	800 ft 240	800 ft 240
Runway Object Free Area Length Beyond RW End <sup>5</sup>	R	1000 ft 300 m	1000 ft 300 m	1000 ft 300 m	1000 ft 300 m	1,000 ft 300 m	1000 ft 300

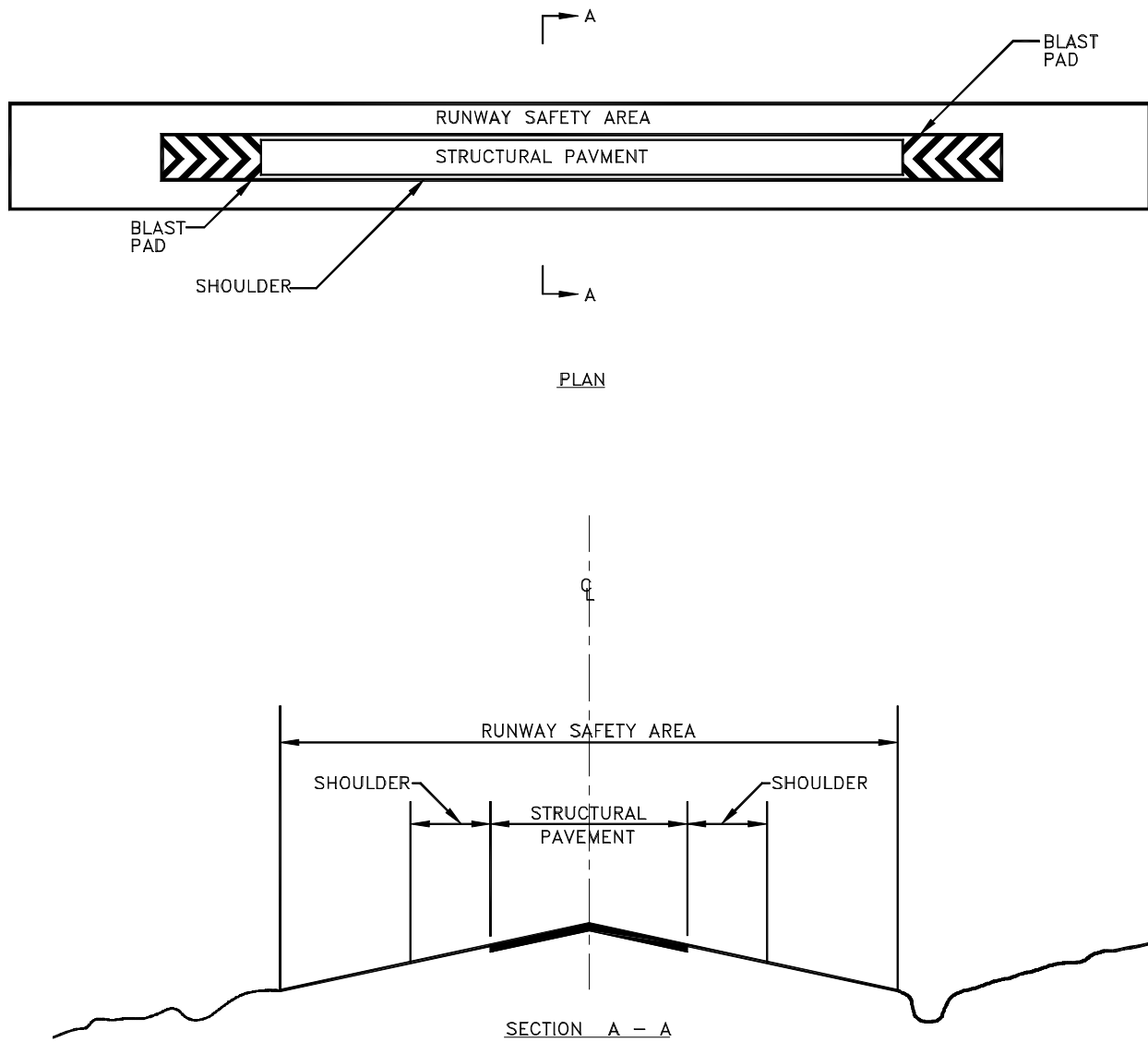
1/ Letters correspond to the dimensions on figures 2-1 and 2-3.

2/ For Airplane Design Group III serving airplanes with maximum certificated takeoff weight greater than 150,000 pounds (68 100 kg), the standard runway width is 150 feet (45 m), the shoulder width is 25 feet (7.5 m), and the runway blast pad width is 200 feet (60 m).

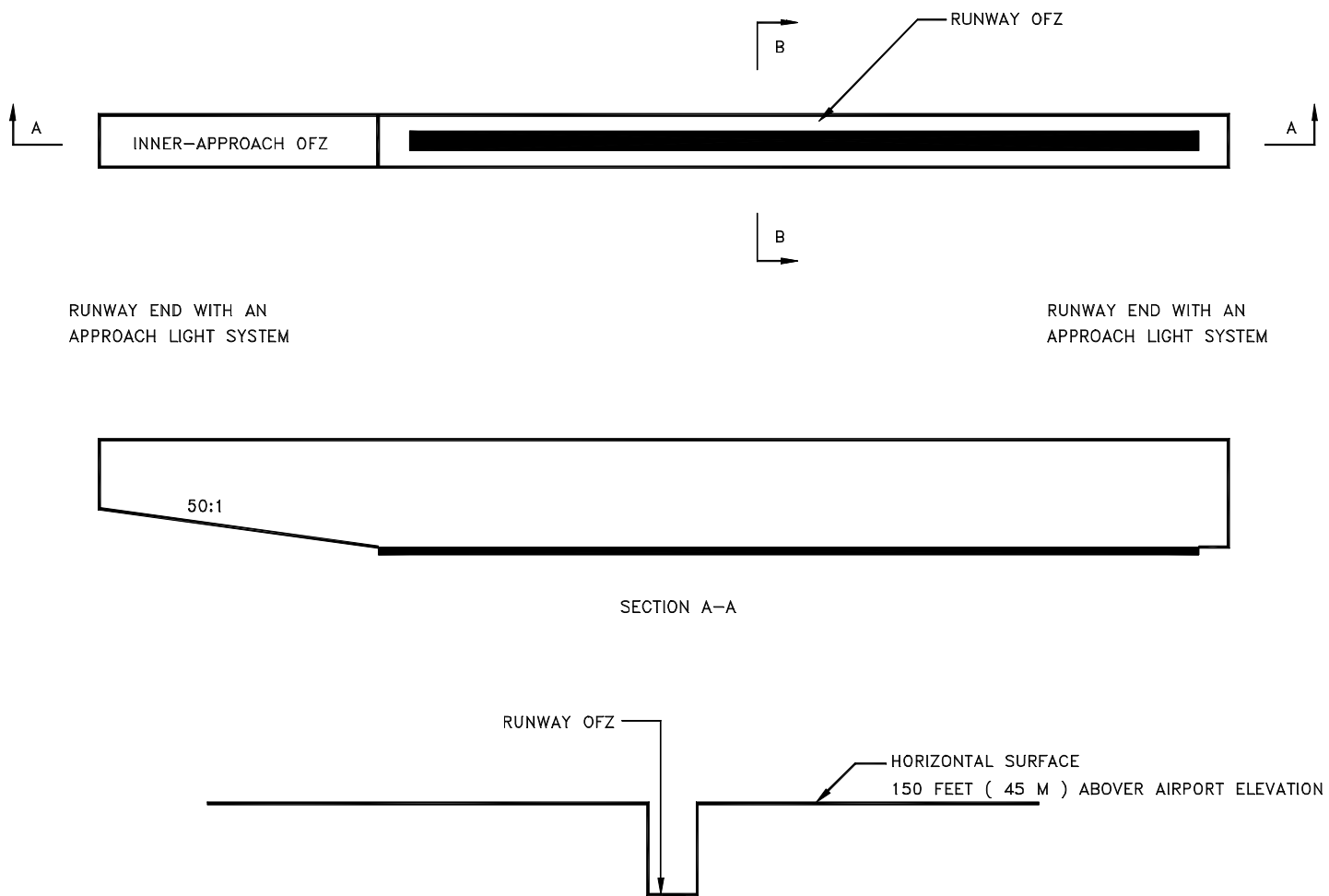
3/ Design Groups V and VI normally require stabilized or paved shoulder surfaces.

4/ For Airport Reference Code C-I and C-II, a runway safety area width of 400 feet (120 m) is permissible. For runways designed after 2/28/83 to serve Aircraft Approach Category D, the runway safety area width increases 20 feet (6 m) for each 1,000 feet (300 m) of airport elevation above MSL. Refer to paragraph 305.

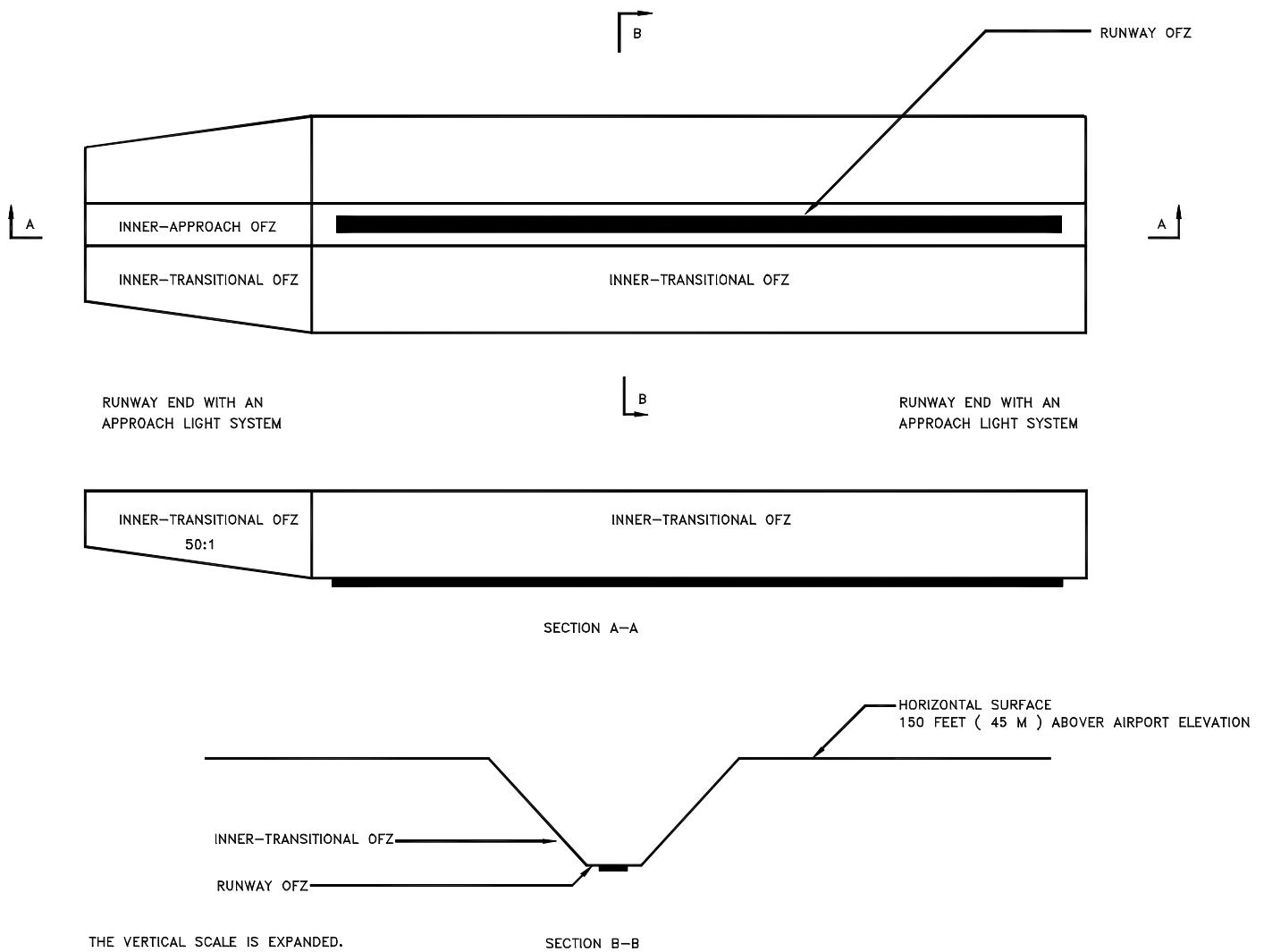
5/ The runway safety area and runway object free area lengths begin at each runway end when stopway is not provided. When stopway is provided, these lengths begin at the stopway end.



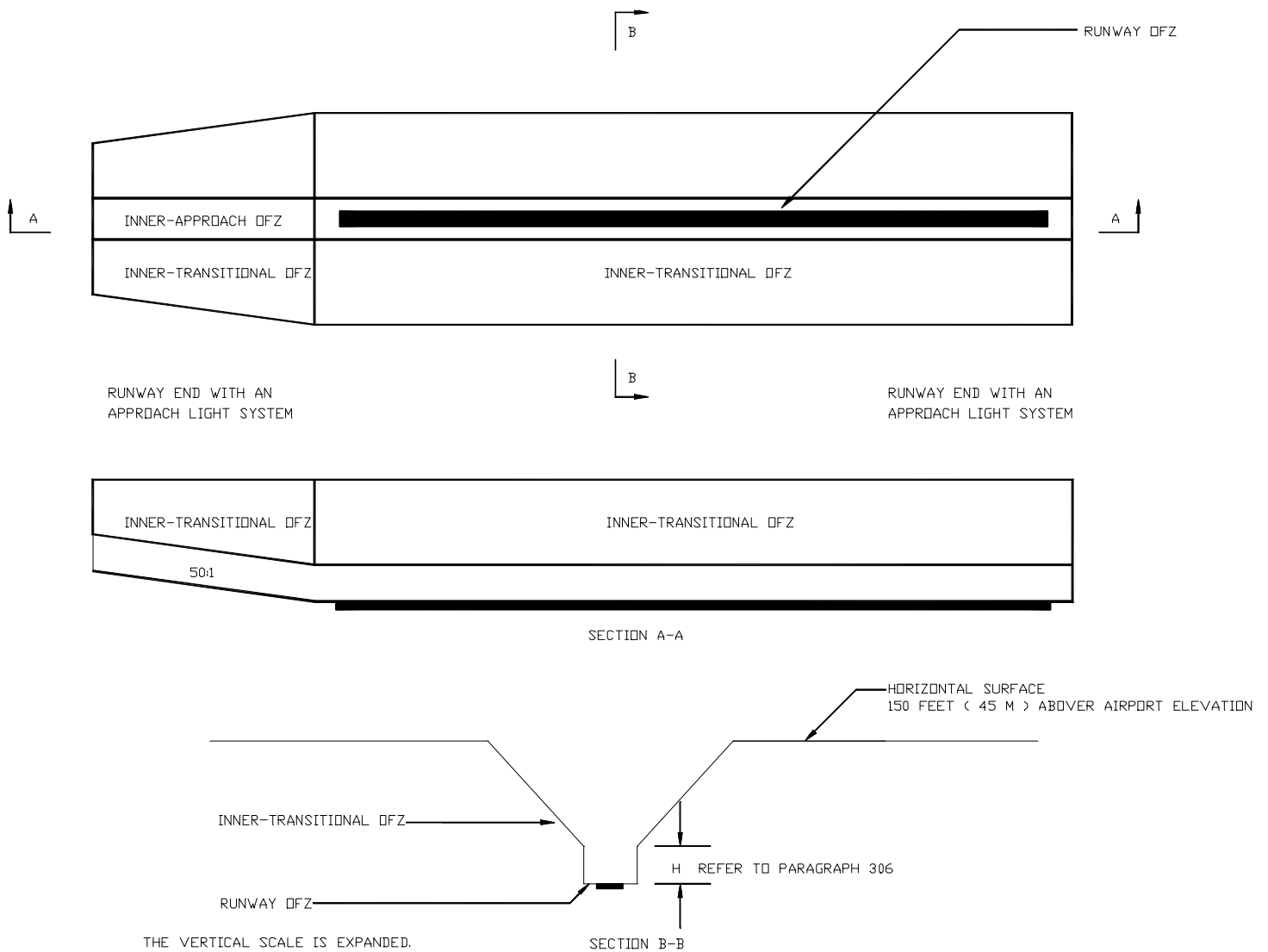
**Figure 3-1. Runway safety area**



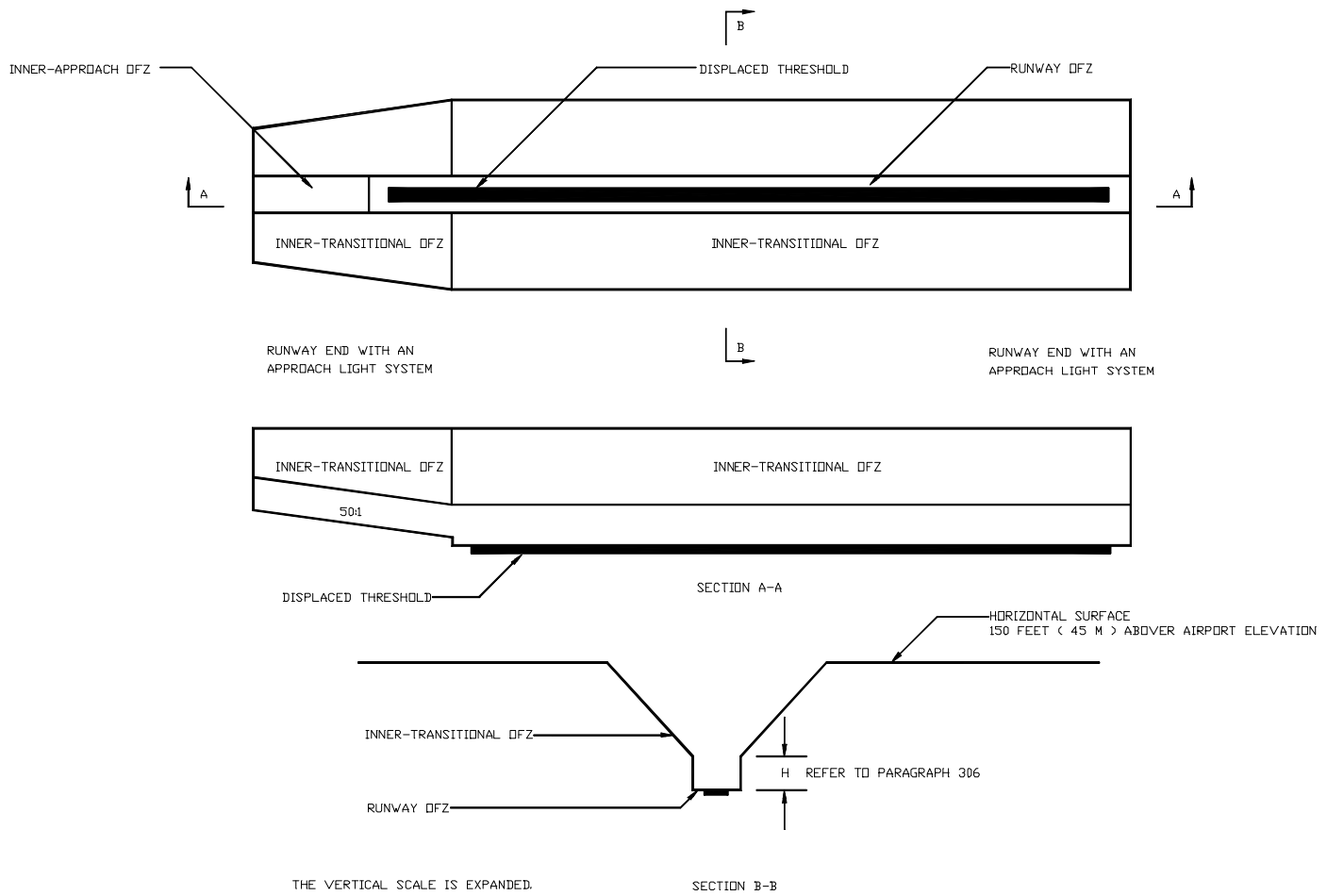
**Figure 3-2. Obstacle free zone (OFZ) for visual runways and runways with not lower than 3/4-statute mile (1 200 m) approach visibility minimums**



**Figure 3-3. Obstacle free zone (OFZ) for runways serving small airplanes exclusively with lower than 3/4-statute mile (1 200 m) approach visibility minimums**



**Figure 3-4. Obstacle free zone (OFZ) for runways serving large airplanes with lower than 3/4-statute mile (1 200 m) approach visibility minimums**



**Figure 3-5. Obstacle free zone (OFZ) for runways serving large airplanes with lower than 3/4-statute mile (1 200 m) approach visibility minimums and displaced threshold**

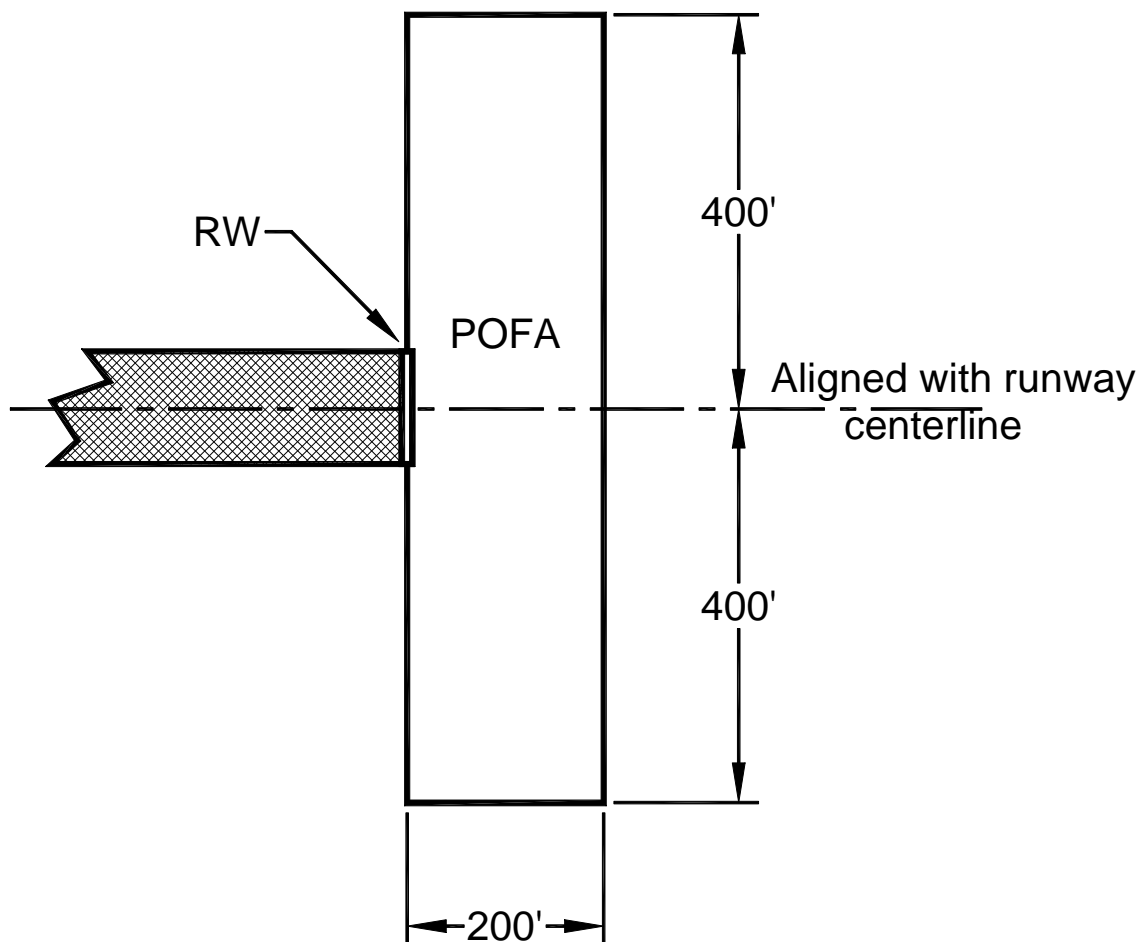
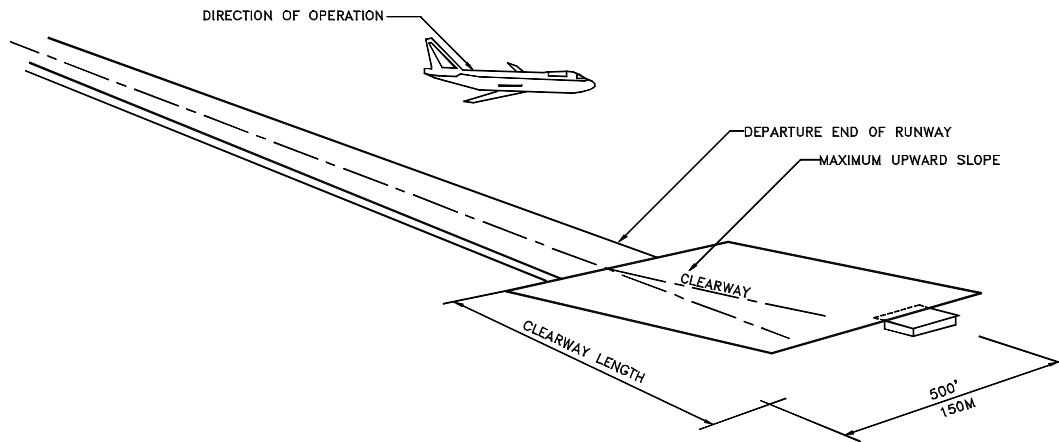
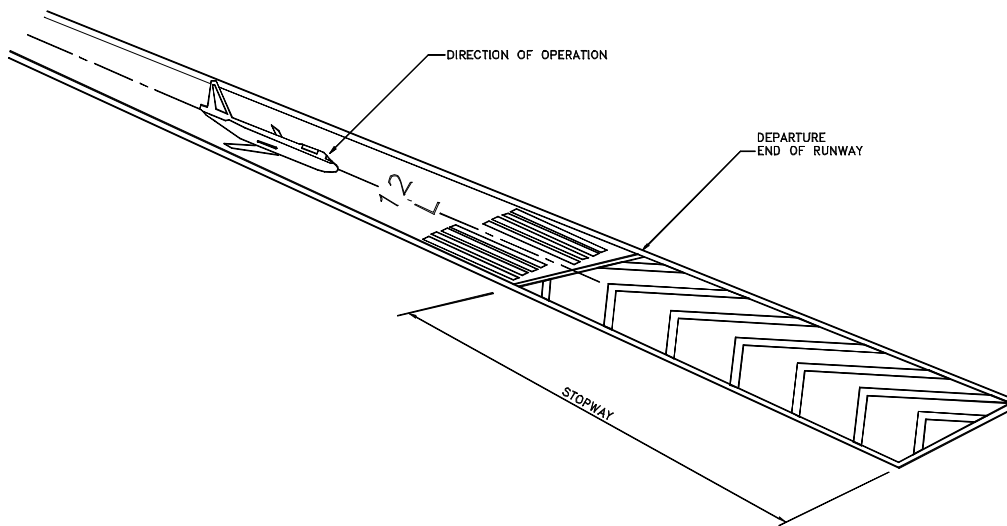


Figure 3-6. Precision Object Free Area



**Figure 3-7. Clearway**



**Figure 3-8. Stopway**

## Appendix 2. THRESHOLD SITING REQUIREMENTS

1. **PURPOSE.** This appendix contains guidance on locating thresholds to meet approach obstacle clearance requirements.

2. **APPLICATION.**

a. The threshold should be located at the beginning of the full-strength runway pavement or runway surface. However, displacement of the threshold may be required when an object that obstructs the airspace required for landing airplanes is beyond the airport owner's power to remove, relocate, or lower. Thresholds may also be displaced for environmental considerations, such as noise abatement, or to provide the standard RSA and ROFA lengths.

b. When a hazard to air navigation exists, the amount of displacement of the threshold should be based on the operational requirements of the most demanding airplanes. The standards in this appendix minimize the loss of operational use of the established runway. These standards reflect FAA policy of maximum utilization and retention of existing paved areas on airports.

c. Displacement of a threshold reduces the length of runway available for landings. Depending on the reason for displacement of the threshold, the portion of the runway behind a displaced threshold may be available for takeoffs in either direction and landings from the opposite direction. Refer to appendix 14 for additional information.

3. **LIMITATIONS.**

a. These standards should not be interpreted as an FAA blanket endorsement of the alternative to displace or relocate a runway threshold. Threshold displacement or relocation should be undertaken only after a full evaluation reveals that displacement or relocation is the only practical alternative.

b. The standards in this appendix are not applicable for identifying objects affecting navigable airspace (14 CFR Part 77) or zoning to limit the height of objects around airports (AC 150/5190-4).

4. **EVALUATION CONSIDERATIONS.**

a. When a penetration to a surface defined in paragraph 5 (threshold siting surfaces) exists, one or more of the following actions is required:

(1) The object is removed or lowered to preclude penetration of applicable threshold siting surfaces;

(2) The threshold is displaced to preclude object penetration of applicable threshold siting surfaces, with a resulting shorter landing distance; or

(3) Visibility minimums are raised.

(4) Prohibit night operations.

b. Relevant factors for evaluation include:

(1) Types of airplanes which will use the runway and their performance characteristics.

(2) Operational disadvantages associated with accepting higher landing minimums.

(3) Cost of removing, relocating, or lowering the object.

(4) Effect of the reduced available landing length when the runway is wet or icy.

(5) Cost of extending the runway if insufficient runway length would remain as a result of displacing the threshold. The environmental and public acceptance aspects of a runway extension need also be evaluated under this consideration.

(6) Cost and feasibility of relocating visual and electronic approach aids, such as threshold lights, visual approach slope indicator, runway end identification lights, localizer, glide slope (to provide a threshold crossing height of not more than 60 feet (18 m)), approach lighting system, and runway markings.

(7) Effect of the threshold change on noise abatement.

## **5. LOCATING, DISPLACING, OR RELOCATING THE THRESHOLD.**

The standard shape, dimensions, and slope of the surface used for locating a threshold is dependent upon the type of aircraft operations currently conducted or forecasted, the landing visibility minimums desired, and the types of instrumentation available or planned for that runway end.

Subparagraphs e, f, and g describe the minimum area required for instrument approach procedures aligned with the runway centerline. For nonprecision approach procedures not aligned with the runway centerline, the area is expanded on the side on which the procedure course lies. This expansion may splay up to 35° from runway. Both the length of these areas and the expansion for offset alignment are determined through instrument approach procedure development.

### **a. For Approach End of Runways Expected to Serve Small Airplanes With Approach Speeds Less Than 50 Knots. (Visual runways only)**

(1) No object should penetrate a surface that starts at the threshold and at the elevation of the runway centerline at the threshold and slopes upward from the threshold at a slope 15 (horizontal) to 1 (vertical).

(2) In the plan view, the centerline of this surface extends 3,000 feet (900 m) along the extended runway centerline. This surface extends laterally 60 feet (18 m) on each side of the centerline at the threshold and increases in width to 150 feet (45 m) at a point 500 feet (150 m) from the threshold; thereafter, it extends laterally 150 feet (45 m) on each side of the centerline. (See figures A2-1 and A2-2.)

### **b. For Approach End of Runways Expected to Serve Small Airplanes With Approach Speeds of 50 Knots or More. (Visual runways only)**

(1) No object should penetrate a surface that starts at the threshold and at the elevation of the runway centerline at the threshold and slopes upward from the threshold at a slope 20 (horizontal) to 1 (vertical).

(2) In the plan view, the centerline of this surface extends 5,000 feet (1 530 m) along the extended runway centerline. This surface extends laterally 125 feet (38 m) on each side of the centerline at the threshold and increases in width to 350 feet (110 m) at a point 2,250 feet (690 m) from the threshold; thereafter, it extends laterally 350 feet (110 m) on each side of the

centerline. (See figures A2-1 and A2-2.)

### **c. For Approach End of Runways Expected to Serve Large Airplanes or instrument minimums $\geq 1$ statute mile, day only.**

(1) No object should penetrate a surface that starts at the threshold and at the elevation of the runway centerline at the threshold and slope upward from the threshold at a slope 20 (horizontal) to 1 (vertical).

(2) In the plan view, the centerline of this surface extends 10,000 feet (3 000 m) along the extended runway centerline. This surface extends laterally 200 feet (60 m) on each side of the centerline at the threshold and increases in width to 500 feet (150 m) at a point 1,500 feet (450 m) from the threshold; thereafter, it extends laterally 500 feet (150 m) on each side of the centerline. (See figures A2-1 and A2-2.)

### **d. For Approach End of Runways Expected to support instrument night circling.**

(1) No object should penetrate a surface that starts 200 feet (60 m) out from the threshold and at the elevation of the runway centerline at the threshold and slopes upward from the starting point at a slope of 20 (horizontal) to 1 (vertical).

(2) In the plan view, the centerline of this surface extends 10,000 feet (3 000 m) along the extended runway centerline. This surface extends laterally 200 feet (60 m) on each side of the centerline at the starting point and increases in width to 1,700 feet (520 m) at the far end of this surface. (See figures A2-1 and A2-2.)

(3) To obtain night minimum, penetrations to this surface can be lighted to avoid displacing the threshold.

### **e. For Approach End of Runways Expected to support instrument straight in night operations.**

(1) No object should penetrate a surface that starts 200 feet (60 m) out from the threshold and at the elevation of the runway centerline at the threshold and slopes upward from the starting point at a slope of 20 (horizontal) to 1 (vertical).

(2) In the plan view, the centerline of this surface extends 10,000 feet (3 000 m) along the extended runway centerline. This surface extends laterally 400 feet (120 m) on each side of the centerline at the starting point and increases in width to 1900 feet (570m) at the far end of this surface. (See figures A2-1 and A2-2.)

(3) If the instrument approach procedure utilizes an offset localizer with an offset angle of 3 degrees or less, the above surface is centered upon the final approach course rather than the extended runway centerline. (See figure A2-3.)

(4) To obtain night minimum, penetrations to this surface can be lighted to avoid displacing the threshold.

f. For Approach End of Runways Expected to Accommodate Instrument Approaches Having Visibility Minimums  $\frac{3}{4}$  Mile but Less Than 1 Mile, Day or Night.

(1) No object should penetrate a surface that starts 200 feet (60 m) out from the threshold and at the elevation of the runway centerline at the threshold and slopes upward from the starting point at a slope of 20 (horizontal) to 1 (vertical).

(2) In the plan view, the centerline of this surface extends 10,000 feet (3 000 m) along the extended runway centerline. This surface extends laterally 400 feet (120 m) on each side of the centerline at the starting point and increases in width to 1900 feet (570m) at the far end of this surface. (See figures A2-1 and A2-2.)

(3) If the instrument approach procedure utilizes an offset localizer with an offset angle of 3 degrees or less, the above surface is centered upon the final approach course rather than the extended runway centerline. (See figure A2-3.)

g. For Approach End of Runways Expected to Accommodate Instrument Approaches Having Visibility Minimums Less Than  $\frac{3}{4}$  Mile, or a Precision Approach, Day or Night.

(4) No object should penetrate a surface that starts 200 feet (60 m) out from the threshold and at the elevation of the runway centerline at the threshold and slopes upward from the starting point at a slope of 34 (horizontal) to 1 (vertical).

(5)

(56) If the instrument approach procedure utilizes an offset localizer with an offset angle of 3 degrees or less, the above surface is centered upon the final approach course rather than the extended runway centerline. (See figure A2-3.)

h. For Approach End of Runways Expected to Accommodate Category II Approach Minimums. Criteria are set forth in TERPS Order 8260.3B.



CAT.	Runway Type	DIMENSIONAL STANDARDS* Feet(Meters)					Slope
		A	B	C	D	E	
a.	Approach end of runways expected to serve small airplanes with approach speeds less than50 knots. (Visual runways only)	0	60 (18)	150 (45)	500 (150)	2,500 (750)	15:1
b.	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more. (Visual runways only)	0	125 (38)	350 (110)	2,250 (690)	2,750 (840)	20:1
c.	Approach end of runways expected to serve large airplanes, or instrument minimums ≥ 1 statute mile, day only.	0	200 (60)	500 (150)	1,500 (450)	8,500 (2,550)	20:1
d. <sup>1</sup>	Approach end of runways expected to support instrument night circling.	200 (60)	200 (60)	1700 (520)	10,000 (3,000)	0	20:1
e. <sup>1</sup>	Approach end of runways expected to support instrument straight in night operations	200 (60)	400 (120)	1900 (550)	10,000 <sup>2</sup> (3,000)	0	20:1
f.	Approach end of having visibility minimums ≥3/4 but < 1 statute mile, day or night.	200 (60)	400 (120)	1900 (570)	10,000 <sup>2</sup> (3,000)	0	20:1
g.	Approach end of runways having visibility minimums <3/4 statute mile or a precision approach, day or night.	200 (60)	400 (120)	1900 (570)	10,000 <sup>2</sup> (3,000)	0	34:1
h.	Approach runway ends having Category II approach minimums or greater.	The criteria are set forth in TERPS order 8260.3B					

- The letters are keyed to those shown on figures A2-2 and A2-3.

Note:

1. Obstacle Penetrations to this surface can be lighted to avoid displacing the threshold.
2. 10,000 feet is a nominal value for planning purposes. The actual length of these areas is dependent on the visual descent point position of the instrument approach procedure.

**Figure A2-1. Dimensional standards for locating thresholds**

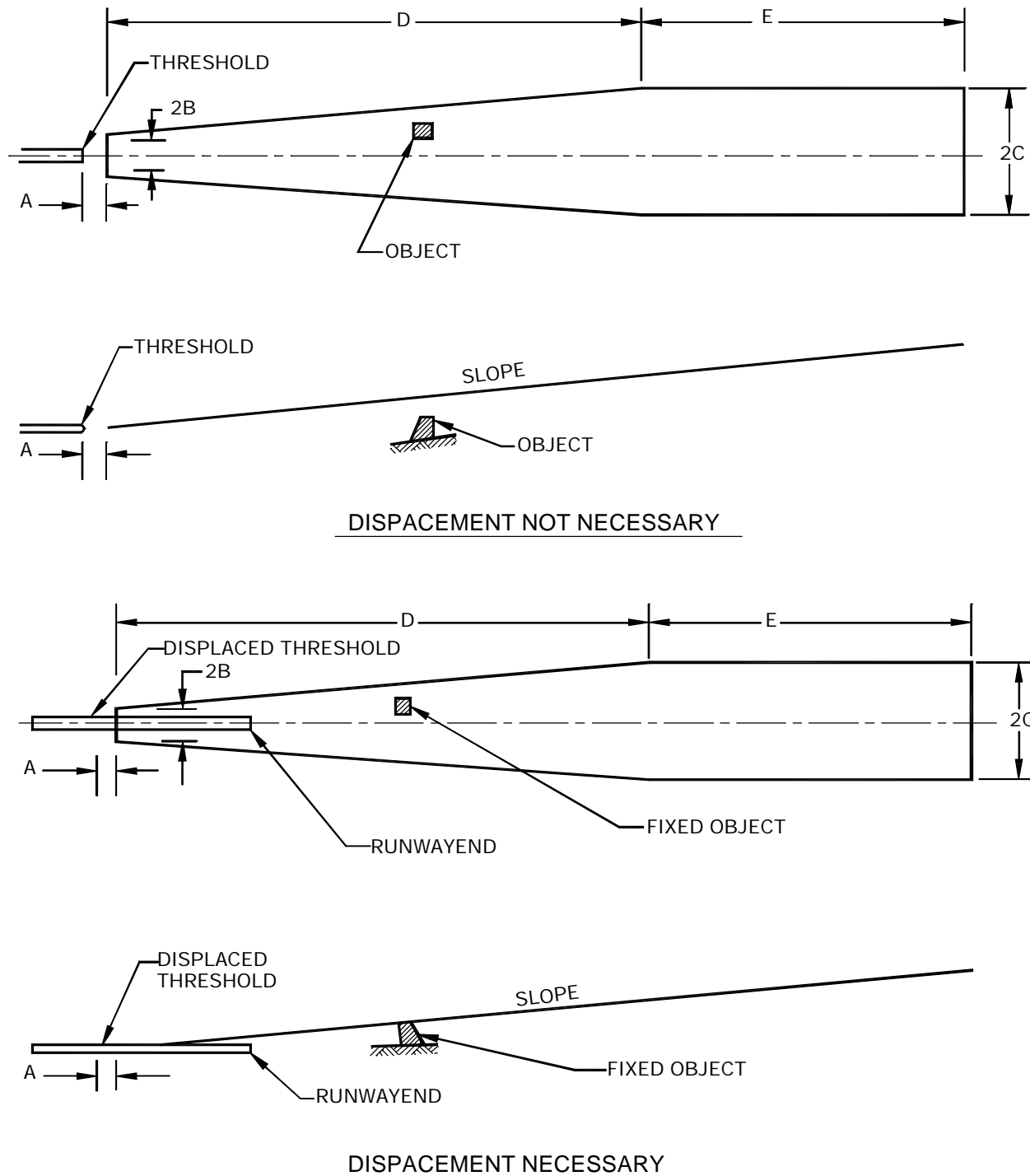


Figure A2-2. Approach slopes

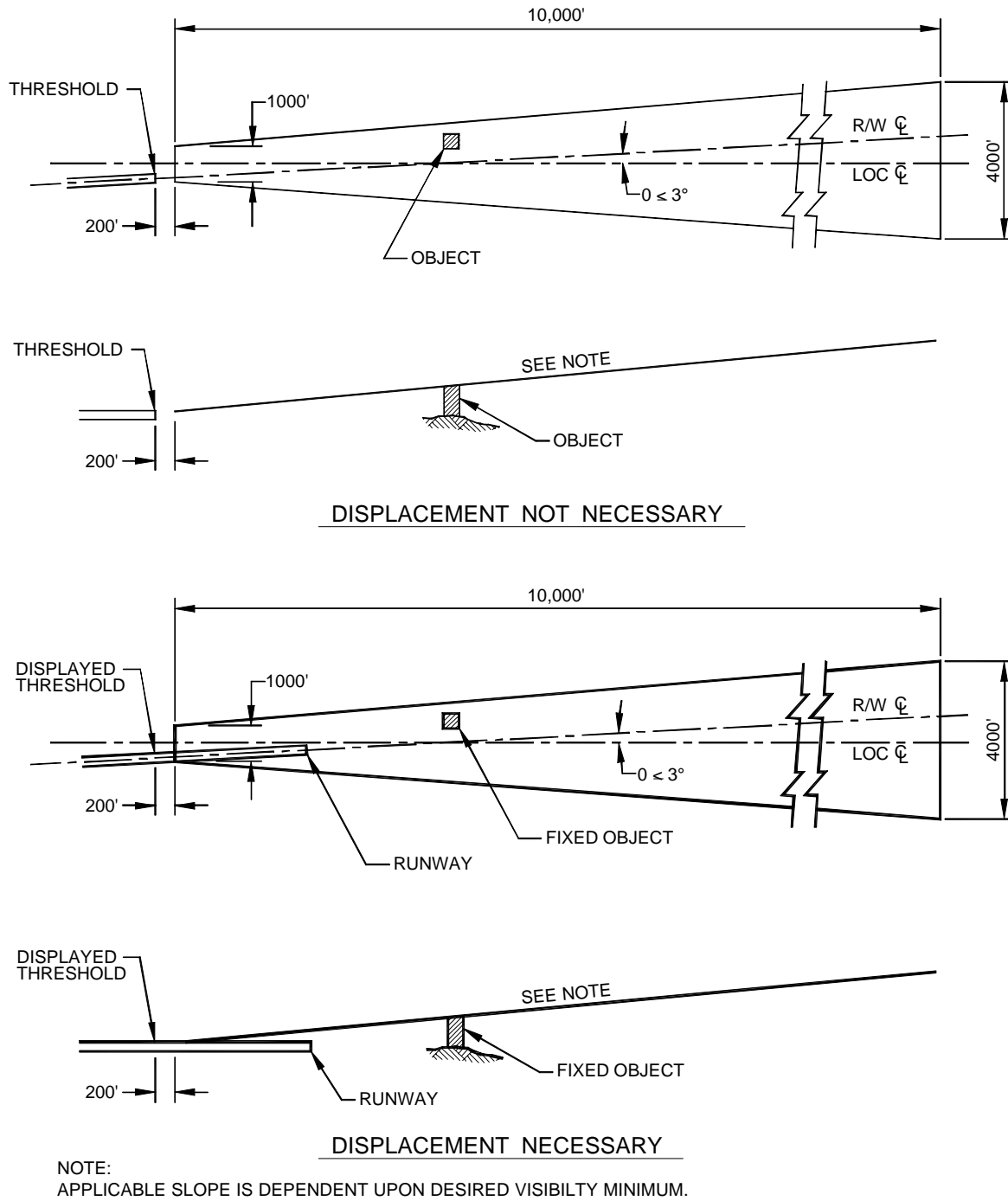


Figure A2-3. Approach slopes--offset localizer

## Appendix 16. NEW INSTRUMENT APPROACH PROCEDURES

**1. BACKGROUND.** This appendix applies to the establishment of new authorized instrument approach procedures. For purposes of this appendix, an Instrument Approach Procedure (IAP) amendment or the establishment of a Global Positioning System (GPS) instrument procedure "overlying" an existing authorized instrument procedure, does not constitute a new procedure. However, a significant reduction in minima would constitute a new procedure.

a. This appendix identifies airport landing surface requirements to assist airport sponsors in their evaluation and preparation of the airport landing surface to support new instrument approach procedures. It also lists the airport data provided by the procedure sponsor that the FAA needs to conduct the airport airspace analysis specified in FAA Order 7400.2. The airport must be acceptable for IFR operations based on an Airport Airspace Analysis (AAA), under FAA Order 7400.2, Procedures for Handling Airspace Matters.

b. FAA Order 8260.19, Flight Procedures and Airspace, reflects the contents of this appendix as the minimum airport landing surface requirements which must be met prior to the establishment of instrument approach procedures at a public use airport. This order also references other FAA requirements, such as a safety analysis to determine the need for approach lighting and other visual enhancements to mitigate the effects of a difficult approach environment. This is a consideration regardless of whether or not a reduction in approach minimums is desired. Airport sponsors are always encouraged to consider an approach lighting system to enhance the safety of an instrument procedure. In the absence of any identified benefits or safety enhancement from an approach light system, sponsors should at least consider installing lower cost visual guidance aids such as REIL or PAPI.

c. The tables provided in this appendix are for planning purposes only and should be used in conjunction with the rest of the document. All pertinent requirements within this AC and other FAA documents, as well as local siting conditions,

ultimately will determine the lowest minimums obtainable.

**2. INTRODUCTION.** To be authorized a new instrument approach procedure, the runway must have an instrument runway designation. Instrument runways are runway end specific. The runway end designation is based on the findings of an AAA study (Refer to Order 7400.2). In addition, the instrument runway designation for the desired minimums must be depicted on the FAA-approved ALP. If not depicted, a change to the ALP is required. As part of the ALP approval process, the FAA will conduct an AAA study to determine the runway's acceptability for the desired minimums.

**3. ACTION.** The airport landing surface must meet the standards specified in tables A16-1 A through C, for each specified runway, direction and have adequate airspace to support the instrument approach procedure. When requesting an instrument procedure, the sponsor must specify the runway direction, the desired approach minimums, whether circling approach procedures are desired, and the survey needed to support the procedure. The sponsor must also provide a copy of the FAA-approved ALP showing the instrument procedure(s) requested for all obligated National Plan of Integrated Airports (NPIAS) airports.

### **4. DEFINITIONS.**

a. **Precision Approach:** An instrument approach procedure providing course and vertical path guidance conforming to ILS, or MLS, precision system performance standards contained in ICAO annex 10. Table A16-1A defines the requirements for ILS, LAAS, WAAS, MLS, and other precision systems.

b. **Nonprecision Approach with Vertical Guidance (IPV)** An instrument approach procedure providing course and vertical path guidance that does not conform to ILS or MLS system performance standards contained in ICAO annex 10, or a precision approach system that does not meet TERPS alignment criteria. Table A16-2B defines the requirements for WAAS and authorized barometric VNAV.

c. **Nonprecision Approach:** An instrument approach procedure providing course guidance without

vertical path guidance. Table A16-3C defines the requirements for VOR, NDB, LDA, GPS (TS)-129) or other authorized RNAV system.



**Table A16-1A. Precision Instrument Approach Requirements.**

<b>Visibility Minimums<sup>1</sup></b>	<3/4 statute mile	< 1-statute mile
<b>Height Above Touchdown<sup>2</sup></b>	200	
<b>TERPS Glidepath Qualification Surface(GQS)<sup>3</sup></b>	Clear	
<b>TERPS precision "W" surfaces<sup>4</sup></b>	Clear	See Note 5
<b>TERPS Paragraph 251</b>	34:1 Clear	20:1 Clear
<b>Precision Object Free Area (POFA) 200 x 800<sup>6</sup></b>	Required	Not Required
<b>Airport Layout Plan<sup>7</sup></b>	Required	
<b>Minimum Runway Length</b>	4,200 ft (1,280 m) (Paved)	
<b>Runway Markings (See AC 150/5340-1)</b>	Precision	Non Precision
<b>Holding Position Signs &amp; Markings (See AC 150/5340-1 and AC 150/5340-18)</b>	Precision	Non Precision
<b>Runway Edge Lights<sup>8</sup></b>	HIRL / MIRL	
<b>Parallel Taxiway<sup>9</sup></b>	Required	
<b>Approach Lights<sup>10</sup></b>	MALSR, SSALR, or ALSF	Recommended
<b>Runway Design Standards; e.g., Obstacle Free Zone (OFZ)<sup>11</sup></b>	< 3/4-statute mile approach visibility minimums	≥ 3/4-statute mile approach visibility minimums
<b>Threshold Siting Criteria To Be Met<sup>12</sup></b>	Appendix 2, Paragraph 5g Criteria	Appendix 2, Paragraph 5f Criteria
<b>Survey Required (see Table 16-2)</b>	Line 9	Line 8

1. Minimums are subject to application of FAA Order 8260.3 (TERPS) and associated orders.
2. The Height Above Touchdown(HAT) indicated is for planning purposes only. Actual obtainable HAT may vary.
3. The Glidepath Qualification Surface (GQS) is applicable to approach procedures providing vertical path guidance. It limits the magnitude of penetration of the obstruction clearance surfaces overlying the final approach course. The intent is to provide a descent path from DA to landing free of obstructions that could destabilize the established glidepath angle. The GQS is centered on a course from the DA point to the runway threshold. It's width is equal to the precision "W" surface at DA, and tapers uniformly to a width 100 feet from the runway edges. If the GQS is penetrated, vertical guidance instrument approach procedures (ILS/MLS/WAAS/LAAS/Baro-VNAV) are not authorized
4. The "W" surface is applicable to precision approach procedures. It is a sloping obstruction clearance surface (OCS) overlying the final approach course centerline. The surface slope varies with glidepath angle. The "W" surface must be clear to achieve lowest precision minimums. Surface slope varies with glide path angle, 102/angle; e.g., for optimum 3° glide path 34:1 surface must be clear.
5. If the W surface is penetrated, HAT and visibility will be increased as required by TERPS.
6. This is a new airport surface see paragraph 307. 250 foot minimum HAT is required without POFA.
7. An ALP is only required for airports in the National Plan of Integrated Airports(NPIAS), it is recommended for all others.
8. Runway edge lighting is required for night minimums. High intensity lights are required for RVR-based minimums.
9. A parallel taxiway must lead to the threshold and, with airplanes on centerline, keep the airplanes outside the OFZ.
10. To achieve lower visibility minimums based on credit for lighting, a TERPS specified approach light system is required.
11. Indicates what chart should be followed in the related chapters of this document.
12. Circling procedures to a secondary runway from the primary approach will not be authorized when the secondary runway does not meet threshold siting (reference Appendix 2), OFZ (reference paragraph 306) criteria, and TERPS paragraph 251 criteria.

**Table A16-1B. Instrument Procedure With Vertical Guidance(IPV) Approach Requirements**

Visibility Minimums <sup>1</sup>	< 3/4-statute mile	< 1-statute mile	1-statute mile	>1-statute mile
Height Above Touchdown <sup>2</sup>	250	300	350	400
TERPS Glidepath Qualification Surface (GQS) <sup>3</sup>	Clear			
TERPS Paragraph 251	34:1 clear	20:1 clear	20:1 clear, or penetrations lighted for night minimums (See AC 70/7460-1)	
Precision Object Free Area (POFA) 200 x 800 <sup>4</sup>	Required	Not Required		
Airport Layout Plan <sup>5</sup>	Required			
Minimum Runway Length	4,200 ft (1,280 m) (Paved)	3,200 ft (975 m) <sup>6</sup> (Paved)	3,200 ft(975 m) <sup>6,7</sup>	
Runway Markings (See AC 150/5340-1)	Precision	Nonprecision <sup>7</sup>		Visual (Basic) <sup>7</sup>
Holding Position Signs & Markings(See AC 150/5340-1 and AC 150/5340-18)	Precision	Nonprecision		
Runway Edge Lights <sup>8</sup>	HIRL / MIRL		MIRL/LIRL	
Parallel Taxiway <sup>9</sup>	Required		Recommended	
Approach Lights <sup>10</sup>	MALSR, SSALR, or ALSF	Recommended		
Runway Design Standards; e.g., Obstacle Free Zone (OFZ) <sup>11</sup>	<3/4-statute mile approach visibility minimums	≥ 3/4-statute mile approach visibility minimums		
Threshold Siting Criteria To Be Met <sup>12</sup>	Appendix 2, Paragraph 5g Criteria	Appendix 2, Paragraph 5f Criteria	Appendix 2, Paragraph 5 a,b,c,d,e Criteria	
Survey Required (see Table 16-2)	Line 7	Line 6	Line 6	Line 6

1. Minimums are subject to the application of FAA Order 8260.3 (TERPS) and associated orders.
2. The Height Above Touchdown (HAT) indicated is for planning purposes only. Actual obtainable HAT may vary.
3. The Glidepath Qualification Surface (GQS) is applicable to approach procedures providing vertical path guidance. It limits the magnitude of penetration of the obstruction clearance surfaces overlying the final approach course. The intent is to provide a descent path from DA to landing free of obstructions that could destabilize the established glidepath angle. The GQS is centered on a course from the DA point to the runway threshold. It's width is equal to the precision "W" surface at DA, and tapers uniformly to a width 100 feet from the runway edges. If the GQS is penetrated, vertical guidance instrument approach procedures (ILS/MLS/WAAS/LAAS/Baro-VNAV) are not authorized
4. This is a new airport surface, see paragraph 307.
5. An ALP is only required for obligated airports in the National Plan of Integrated Airports(NPIAS), it is recommended for all others.
6. Runways less than 3,200' are protected by 14 CFR Part 77 to a lesser extent. However runways as short as 2400 feet could support an instrument approach provided the lowest HAT is based on clearing any 200 foot obstacle within the final approach segment.
7. Unpaved runways require case-by-case evaluation by regional Flight Standards personnel.
8. Runway edge lighting is required for night minimums. High intensity lights are required for RVR-based minimums.
9. A parallel taxiway must lead to the threshold and, with airplanes on centerline, keep the airplanes outside the OFZ.
10. To achieve lower visibility minimums based on credit for lighting, a TERPS specified approach light system is required.
11. Indicates what chart should be followed in the related chapters in this document.

12. Circling procedures to a secondary runway from the primary approach will not be authorized when the secondary runway does not meet threshold siting (reference Appendix 2), OFZ (reference paragraph 306) and TERPS paragraph 251 criteria.

**Table A16-1C. Nonprecision Approach Requirements**

Visibility Minimums <sup>1</sup>	< 3/4-statute mile	< 1-statute mile	1-statute mile	>1-statute mile
Height Above Touchdown <sup>2</sup>	300	350	400	450
TERPS Paragraph 251	34:1 clear	20:1 clear	20:1 clear or penetrations lighted for night minimums (See AC 70/7460-1)	
Precision Object Free Area (POFA) 200 x 800 <sup>3</sup>	Required	Not Required		
Airport Layout Plan <sup>4</sup>	Required			
Minimum Runway Length	4,200 ft (1,280 m) (Paved)	3,200 ft (975 m) <sup>5</sup> (Paved)	3,200 ft (975 m) <sup>5,6</sup>	
Runway Markings (See AC 150/5340-1)	Precision	Nonprecision <sup>6</sup>		Visual (Basic) <sup>6</sup>
Holding Position Signs & Markings (See AC 150/5340-1 and AC 150/5340-18)	Precision	Nonprecision		
Runway Edge Lights <sup>7</sup>	HIRL / MIRL		MIRL / LIRL	
Parallel Taxiway <sup>8</sup>	Required		Recommended	
Approach Lights <sup>9</sup>	MALSR, SSALR, or ALSF Required	Required <sup>10</sup>	Recommended	
Runway Design Standards, e.g. Obstacle Free Zone (OFZ) <sup>11</sup>	<3/4-statute mile approach visibility minimums	≥ 3/4-statute mile approach visibility minimums		
Threshold Siting Criteria To Be Met <sup>12</sup>	Appendix 2, Paragraph 5g Criteria	Appendix 2, Paragraph 5f Criteria	Appendix 2, Paragraph 5 a,b,c,d,e Criteria	
Survey Required (see Table 16-2)	Line 5	Line 4	Line 3	Line 3 Line 2

1. Minimums are subject to the application of FAA Order 8260.3 (TERPS) and associated orders.
2. The Height Above Touchdown(HAT) indicated is for planning purposes only. Actual obtainable HAT may vary.
3. This is a new airport surface, paragraph 307.
4. An ALP is only required for obligated airports in the National Plan of Integrated Airports(NPIAS), it is recommended for all others.
5. Runways less than 3,200' are protected by 14 CFR Part 77 to a lesser extent. However runways as short as 2400 feet could support an instrument approach provided the lowest HAT is based on clearing any 200 foot obstacle within the final approach segment.
6. Unpaved runways require case-by-case evaluation by regional Flight Standards personnel.
7. Runway edge lighting is required for night minimums. High intensity lights are required for RVR-based minimums.
8. A parallel taxiway must lead to the threshold and, with airplanes on centerline, keep the airplanes outside the OFZ.
9. To achieve lower visibility minimums based on credit for lighting, a TERPS specified approach lighting system is required.
10. ODALS, MALS, SSALS, SALS are acceptable.
11. Indicates what chart should be followed in the related chapters in this document
12. Circling procedures to a secondary runway from the primary approach will not be authorized when the secondary runway does not meet threshold siting (reference Appendix 2), OFZ (reference paragraph 306), and TERPS paragraph 251 criteria.



**Table A16-2. Survey Requirements for Instrument Approach Procedures:**

The Table indicates the acceptable runway obstruction survey needed to support an instrument approach procedure.

	Approach	Runway Survey Type								
		None	AV	BV	ANP	C	SUPLC	D	ANAPC	PIR
1	Night Circling			X	X	X	X	X	X	X
2	Non-Precision Approach $\geq$ 1SM, Day Only	X	X	X	X	X	X	X	X	X
3	Non-Precision Approach $\geq$ 1SM				X	X	X	X	X	X
4	Non-Precision Approach $<$ 1SM					X	X	X	X	X
5	Non-Precision Approach $<$ $\frac{3}{4}$ SM								X	X
6	NPV Approach $\geq$ $\frac{3}{4}$ SM							X	X	X
7	NPV Approach $<$ $\frac{3}{4}$ SM								X	X
8	Precision CAT I Approach $<$ 1SM							X	X	X
9	Precision CAT I Approach $<$ $\frac{3}{4}$ SM								X	X
10	Precision CAT II Approach									X
11	Precision CAT III Approach									X

**Note:**

An “X” in each column for a given Approach (1 through 11) denotes a survey that is acceptable to support that approach. As shown, multiple surveys may support the approach, however the “X” farthest to the left indicates the minimum survey needed.

Runway survey types from FAA No. 405, Standards for Aeronautical Surveys and Related Products:

**AV** - FAR77 Visual Approach - Utility runway, includes approach and primary surfaces only.

**BV** - FAR77 Visual Approach, includes approach and primary surfaces only.

**ANP** - FAR77 Nonprecision Approach - Utility runway, includes approach and primary surfaces only.

**C** - FAR77 Nonprecision Approach - Visibility minimums greater than  $\frac{3}{4}$  mile includes approach and primary surfaces only.

**SUPLC** - C Approach underlying a BV approach, includes approach and primary surfaces only.

**D** - FAR77 Nonprecision Approach - Visibility minimums as low as  $\frac{3}{4}$  mile includes approach and primary surfaces only.

**ANAPC** - Area Navigation Approach - Precision, conventional landing, includes approach, primary, transition, and missed approach surfaces.

**PIR** - FAR77 Precision Instrument Approach, includes approach and primary surfaces only.